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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/567,028	10/11/2006	Charles Simon James Pickles	285545US2X PCT	9920

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EXAMINER	
DIETERLE, JENNIFER M	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/567,028	PICKLES ET AL.	
	Examiner	Art Unit	
	Jennifer Dieterle	4111	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 2/3/06.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-15 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-15 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 2/3/06, 4/26/06.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

Claims 1-15 are pending.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 1, 3, 8, 9, 10, 11, 12 and 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Shiomi et al. (U.S. Pat. No. 5,844,252).

<u>Regarding claims 1, 3, 11, 12 and 15</u>, Shiomi et al. (in figures 2A-2F and figure 6 and col.6, lines 37-41; col. 7, lines 13-15), teach an apparatus comprising: a nonconducting undoped polycrystalline diamond layer (see figure 2D, 13) in electrical connection with an electrically-conducting boron-doped polycrystalline diamond projections (e.g., diamond layer figure 2D, 12 and etched electron emission portions 122 that comprise a number or protruberances and recesses) extending at least partially through the layer of nonconducting diamond (figure 2D, 13).

<u>Regarding claim 8</u>, Shiomi et al. (in figure 6, col. 8, lines 25-17-32) teach patterned aluminum layers (figure 6, 404) that function as gate electrodes placed on the nonconducting diamond layer (figure 6, 411) which is a surface through which the

conducting diamond layer (figure 6, 410) is connected. The circuit comprises current meters (figure 6, 414 and 416) which are an external circuit. Shiomi et al. also teach that the areas of conducting diamond are internally connected within the diamond layer by an electrode (figure 6, 402).

Regarding claim 9, application's specification at 0014 states that, "the contact surface of the diamond could be coated with one or more layers of conductive material, optionally in combination with one or more non-conductive layers, to provide `on board` interconnection." Shiomi et al. (in figure 6, col. 8, lines 25-27) teach that there are gate electrodes or aluminum layers (figure 6, 404), which are conductive, in contact with a nonconductive layer (figure 6, 411) which would provide the interconnection of the electrically conducing diamond layer.

Regarding claim 10, Shiomi et al. (in figure 6, col. 8, lines 23-28) has gate electrodes or aluminum, metal, layers through which anode (figure 6, 402) is connected. An electric field that the substrate is exposed to in certain embodiments may be created by any suitable technique, for example, by electrodes that are externally connected to the substrate, through metal portions of the substrate. Therefore, areas of the electrically conducting diamond are externally electrically connected into an electrode. Additionally, Shiomi et al. teach a cathode (figure 6, 406) is connected to the substrate (figure 6, 408) and the cathode would be externally connected to the conducting diamond layer because it is first connected to the substrate and not directly connected to the conducting diamond.

2. Claims 1, 2, 8, 11, 12, 13, 14 and 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Yamazaki (U.S. Pat. No. 5,089,802).

Regarding claims 1, 2, 11, 12 and 15, Yamazaki (in figure 1C, col. 2, lines 64-68; col. 3, lines 4-7)teaches an apparatus comprising: a nonconducting undoped polycrystalline diamond layer (figure 1C, 2, col. 4, lines 54-55) in electrical connection with coplanar electrically-conducting boron-doped polycrystalline diamond projections (figure 1C, 10-1, 10-2) extending at least partially through the layer of nonconducting diamond.

Regarding claim 8, Yamazaki (in figure 1C, col. 3, lines 25-26, 30-31) teaches areas of electrically conducting diamond (figure 1C, 10-1, 10-2) in electrical connection with nonconducting diamond (figure 1C, 2; they are side-by-side) through which they can be connected to an external circuit (figure 1C; 5-1, 5-2 are electrodes and 7-1, 7-2 are leads).

Regarding claims 13 and 14, Yamazaki teaches that the areas of electrically conducting diamond and co-planer surface are smooth (see figure 1B). If the surfaces are smooth, they are not rough and therefore would have a surface roughness of less than 100nmRa.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 2, 4, 13 and 14 are rejected under 35 U.S.C. 103(a) as being obvious over Shiomi et al. (U.S. Pat. No. 5,844,252) in view of Yamazaki (U.S. Pat. No. 5,089,802).

Regarding claim 2, Shiomi et al. teach a device having projections that extend to the surface of the layer of nonconducting diamond presenting areas of electrically conducting diamond, however, Shiomi et al. does not teach that the conducting layer is completely coplanar with the nonconducting layer.

Yamazaki teaches that the conducting and nonconducting layers can be coplanar (see figure 1B).

Therefore, it would have been obvious to one skilled in the art to modify the pins or projections of conducting diamond in the device of Shiomi et al. to be coplanar with the nonconducting diamond as taught by Yamazaki because the conducting diamond will still perform and have excellent electron emitting characteristics with or without increased surface area of a pin or projection shape.

Regarding claim 4, Shiomi et al. teach a device that has circular areas of electrically conducting diamond. As evidenced by figure 2D, the projections or protuberances can be cones or cylinders (col. 5, line 27). Applicant's specification at section 0009 describes the pins as having a round profile on the analysis surface. No other description is provided, therefore, a cone or cylinder does have a "round" profile. "Round" can mean a circle. When looking down upon a cylinder, it has a "round" or circular top. Additionally, a cone also has a point or a top. While a cone's top is smaller than its bottom, its top is circular in shape or "round." Additionally, if one were to cut across a cone or cylinder at any point, a circular shape would be achieved that would be in contact with the substance to be measured. Therefore, both a cone and cylinder shape have circular or "round" shapes and can be coplanar with the nonconductive surface as evidenced in claim 2 above.

Regarding claims 13 and 14, Shiomi et al. teach a device comprising a conducting diamond film layer in which the conducting diamond layer form pins or

projections extending through a layer of nonconducting diamond forming well shaped recessions having rough edges of conducting diamond film.

Shiomi et al. does not teach a device with smooth edges on the conducting diamond film channel/well layer.

Yamazaki teaches that the areas of electrically conducting diamond and co-planer surface are smooth (figure 1B). If the surfaces are smooth, they are not rough and therefore would have a surface roughness of less than 100nmRa.

Therefore, it would have been obvious to one skilled in the art to modify the surface of the conducting diamond to be smooth as taught by Yamazaki because a smooth diamond layer would provide a uniform thickness and a shape which can be uniformly filled with a know amount of additive.

4. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being obvious over Shiomi et al. (U.S. Pat. No. 5,844,252) and Yamazaki (U.S. Pat. No. 5,089,802), as applied to claims 1, 2 or 3 above, in view of Malinski et al. (U.S. Pat. No. 5,603,820).

<u>Regarding claims 5 and 6</u>, Shiomi et al. teach a device having a conductive and nonconductive diamond layer with wells, however, it does not teach that the wells contain an additive that modifies the sensitivity or selectivity of the device.

Malinski et al. teach an electrode sensor that has a coating of the gas-permeable membrane as previously, such as Nafion, that may be applied onto the electrode by any suitable means (col. 9, line 5). The membrane modifies the sensitivity or selectivity of the electrode because now a specific gas will bind or interact with the membrane (col. 9, lines 15-21).

Therefore, it would have been obvious to one skilled in the art to modify the wells of Shiomi et al. by covering them with using a membrane which would be coplanar with the nonconductive surface as taught by Malinski because a membrane will change the selectivity of the electrode behavior in that it will increase selectivity or specificity for a certain gas or analyte thus promoting detection and efficiency of the device.

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being obvious over Shiomi et al. and Malinski et al. (U.S. Pat. No. 5,603,820), as applied to claims 5 or 6, in view of Buttery et al. (U.S. Pat. No. 5,405,618).

Regarding claim 7, Shiomi et al., in view of Malinski et al., teach a device which have a membrane that modifies the sensitivity or selectivity of the electrode, but does not teach that the membrane has an electrochemical (bio-)chemical.

Buttery et al. teach a biomosaic polymer which has biologically active material bound at its surfaces. The biomosaic polymers may be formed into membranes, films, beads, or other structures for a variety of assays. The polymer may be a porous membrane, and the biologically active material may be useful for biospecific reactions such as immunoassays, bioseparations, enzyme-catalyzed reactions and the like (abstract and field of invention).

Therefore, it would have been obvious to one skilled in the art to modify the polymer layer of Shiomi et al. to contain a biochemical as taught by Buttery et al. because a biochemical additive would allow for the selectivity of particular material such as antigen in a biological sample.

6. Claims 3, 4, 9 and 10 are rejected under 35 U.S.C. 103(a) as being obvious over Yamazaki (U.S. Pat. No. 5,089,802) in view of Shiomi et al. (U.S. Pat. No. 5,844,252).

Regarding claim 3 Yamazaki teaches a device having doped diamond layers extending at least partially through the layer of nonconducting diamond, but does not teach the formation of wells.

Shiomi et al. teach a device which having doped diamond layers extending at least partially through the layer of nonconducting diamond that form wells.

Therefore, it would have been obvious to one skilled in the art to modify the device of Yamazaki to recess the doped layers in order to form wells as taught by Shiomi et al. because the wells would allow for the addition of an additive that can be analyte specific.

Regarding claim 4, Yamazaki teaches a device having doped and undoped diamond layers, but does not teach a well or an additive in the well.

Shiomi et al. teach a device that has wells as described in claim 3 above and circular areas of electrically conducting diamond. As evidenced by Shiomi et al. figure 2D, the projections or protuberances can be cones or cylinders (col. 5, line 27). Applicant's specification at section 0009 describes the pins as having a round profile on the analysis surface. No other description is provided, therefore, a cone or cylinder does have a “round" (i.e. circular) profile on the analysis surface. When looking down upon a cylinder, it has a "round" or circular top. Additionally, a cone also has a point or a top. While a cone's top is smaller than its bottom, its top is circular in shape or “round.” Additionally, if one were to cut across a cone or cylinder at any point, a circular

shape would be achieved that would be in contact with the substance to be measured. Therefore, both a cone and cylinder shape have circular or “round” analysis surface.

Therefore, it would have been obvious to one skilled in the art to modify the device of Yamazaki to make the recessed areas have a round analysis surface as taught by Shiomi et al. because a round profile provides for multiple working electrode areas.

Regarding claims 9 and 10, Yamazaki teaches a device having doped and undoped diamond layers, but does not teach area of electrically conducting diamond are internally electrically connected.

Application’s specification at 0014 states that, “the contact surface of the diamond could be coated with one or more layers of conductive material, optionally in combination with one or more non-conductive layers, to provide `on board` interconnection.” Shiomi et al. teach that there are aluminum layers 404 (figure 2D), which are conductive, in contact with a nonconductive layer 411 which would provide the interconnection of the electrically conducing diamond layer. Shiomi et al. has aluminum, metal, layers through which anode 402 is connected. An electric field that the substrate is exposed to in certain embodiments may be created by any suitable technique, for example, by electrodes that are externally connected to the substrate, through metal portions of the substrate. Therefore, areas of the electrically conducting diamond are externally electrically connected into an electrode. Additionally, Shiomi et al. teach a cathode 406 is connected to the substrate 408 and the cathode would be

externally connected to the conducting diamond layer because it is first connected to the substrate and not directly connected to the conducting diamond.

Therefore, it would have been obvious to one skilled in the art to modify the device of Yamazaki to include an electrically conducting layer such as aluminum to provide an interconnection of the electrically conducting diamond layer and have an additional electrode connected to a separate layer separating it from the conducting layer, thus being externally connected as taught by Shiomi et al. because

7. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being obvious over Yamazaki (U.S. Pat. No. 5,089,802) and Shiomi et al. (U.S. Pat. No. 5,844,252), as applied to claim 1, 2 or 3 above, in view of Malinski et al. (U.S. Pat. No. 5,603,820).

Regarding claims 5 and 6, Yamazaki, in view of Shiomi et al., teaches a device having a conductive and nonconductive diamond layer with wells; however, it does not teach that the wells contain an additive that modifies the sensitivity or selectivity of the device.

Malinski et al. teach an electrode sensor that has a coating of the gas-permeable membrane as previously, such as Nafion, that may be applied onto the electrode by any suitable means (col. 9, line 5). The membrane modifies the sensitivity or selectivity of the electrode because now a specific gas will bind or interact with the membrane col. 9, lines 15-21).

Therefore, it would have been obvious to one skilled in the art to modify the wells of Yamazaki by covering them with a membrane which would be coplanar with the nonconductive surface as taught by Malinski because a membrane will change the

selectivity of the electrode behavior in that it will increase selectivity or specificity for a certain gas or analyte thus promoting detection and efficiency of the device.

8. Claim 7 is rejected under 35 U.S.C. 103(a) as being obvious over Yamazaki, Shiomi et al. and Malinski et al., as applied to claim 5 or 6 above, and in view of Buttery et al. (U.S. Pat. No. 5,405,619).

Regarding claim 7, Yamazaki, in view of Shiomi et al. and Malinski et al., teaches a device which has a membrane that modifies the sensitivity or selectivity of the electrode, but does not teach that the membrane has an electrochemical (bio-)chemical.

Buttery et al. teach a biomosaic polymer which has biologically active material bound at its surfaces. The biomosaic polymers may be formed into membranes, films, beads, or other structures for a variety of assays. The polymer may be a porous membrane, and the biologically active material may be useful for biospecific reactions such as immunoassays, bioseparations, enzyme-catalyzed reactions and the like (abstract and field of invention).

Therefore, it would have been obvious to one skilled in the art to modify the polymer layer of Yamazaki to contain a biochemical as taught by Buttery et al. because a biochemical additive would allow for the selectivity of particular material such as antigen in a biological sample.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Tessmer et al. teach that two or more layers of various doped or

undoped (col. 5, lines 28-31) diamond films can be deposited on a substrate to form a diamond multi-layer structure in which the diamond can be natural, synthetic, or can be polycrystalline diamond (e.g., grown by a CVD technique)(col. 3, lines 39-42). Tessmer et al. teach a process of etching, using a conventional diamond etching technique, to form a mesa structure (col. 5, lines 34-35). The mesa structure is a channel/well structure in which some layers are higher than others (see figures 2B-E). Etching is performed using ECR, electron beam assisted plasma etching (EBAPE), oxidation, or some other diamond etching technique until the desired mesa height is reached making a substantially smooth diamond layer having a predetermined thickness on a substrate (col. 5, lines 38-41).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer Dieterle whose telephone number is (571) 270-7872. The examiner can normally be reached on Monday thru Friday, 8am to 5pm (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Nam X Nguyen/
Supervisory Patent Examiner, Art Unit 1753

JMD
4/23/09